ONTARIO MINISTRY OF ENVIRONMENT
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1970

OPERATING SUMMARY

OWRC WATER TREATMENT PLANTS

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ONTARIO WATER RESOURCES COMMISSION

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Ontario Water Resources
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ONTARIO WATER RESOURCES COMMISSION

1970 ANNUAL OPERATING SUMMARY

WATER TREATMENT PLANTS

Prepared by the Project Services Section
Division of Plant Operations

September, 1971

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INTRODUCTION

The first summary of water treatment plant operation was prepared in 1967. It was a summary of the data then being collected. Since that time, changes have been made to allow collection of more relevant data and to improve methods of collection and presentation.

This report contains summaries of operating costs and treatment results. There is no attempt made to delineate operating problems at individual plants. The nature of these problems, along with more detailed data, is contained in individual plant operating summaries.

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PLANTS INCLUDED IN REPORT

PROJECT	NUMBER	RAW WATER SOURCE	DESIGN CAPACITY in million imperial gallons per day							STORAGE CAPACITY
			INTAKE	PUMPS		MICRO-	SETTLING	FILTERS		
			or WELL	LOW LIFT	HIGH LIFT	STRAINER	TANK		@ gpm/ft²	mil gal
1. Beaverton	6-0083-61	Lake Simcoe	> 1	.8 (Service pumps)				0.55	1.7	.10
2. Bertie Twp.	6-0047-69	Lake Erie		9.0	8.6	4.5				.88
3. Bobcaygeon	5-0006-66	Big Bob River		.27 (Filter pumps)				0.20	0.5	
4. Dresden	6-0007-57	Sydenham River		.86	.86		.5			.86
5. Dunnville	6-0017-58	Lake Erie		24	58	20.5				.2
6. Eganville	6-0093-61	Bonnechere River						0.18	1.6	
7. Fauquier Twp.	6-0078-61	Well	.14	.07 (Service pump)				0.07	1.6	
8. Fenelon Falls	6-0057-60	Cameron Lake		.49 (Service pumps)				.36	2.5	.008
9. Goderich	6-0069-60	Lake Huron	6.4	2.6	2.8			1.5	1.8	.54
10. Harrow	6-0004-57	Lake Erie	8		3.4	1.25				.25
KING TWP.	6-0061-60									
11. Oak Ridges		Well				Softeners 0.47				.10
12. Schomberg		Well	.14	.14 (Well pump)		Softeners 0.18				.10
LAKE ERIE	5-0002-65									
13. St. Thomas		Kettle Creek	3.3	5.5	6.0			4.9	2.0	
Lake Supply		Lake Erie		10	3.5	No treatment				6
Wells		Wells	0.4							
14. Lake Huron	5-0001-64	Lake Huron	100	42	37			40	2.1	13.4
15. Marmora	6-0025-58	Crow River		.22* (Duty pump)				.50	2.6	.44
16. Meaford	6-0029-59	Nottawasaga Bay		6.0	3.7			2.9	1.6	.33
17. Mitchell	6-0042-59	Well		2.0	1.1			.72	2.5	.06
18. Moosonee	5-0004-66	Store Creek		.14	.20		.15	.12	1.5	
19. Southampton	6-0124-63	Lake Huron		2.0** (Filter pumps)				1.0	1.7	.10
SOUTH PEEL	5-0020-66									
20. Brampton		Well	1.8							
21. Lakeview		Lake Ontario						24	2.0	
22. Union	6-0012-57	Lake Erie	32	12	23	15.6	16	10.0	2.8	2.0
23. Warkworth	6-0148-65	Mill Creek		.14	.22			.10	2.0	.11
24. Whitby Twp.	6-0053-59	Well	.22					.16	2.5	.075

* Plus 100% standby

** Plus 3 mgd diesel

PLANT FLOWS

Graph No. 1 displays average and maximum daily flows as percentages of nominal capacities of the treatment plants - the plants are ranked in order of decreasing average loading.

Table I summarizes flow data, including maximum rates where available. The nominal capacities listed, where limited by filter capacity, do not include reductions in potential output due to backwashing of filters. These capacities, therefore, represent maxima at the given hydraulic loading.

GRAPH No. 1

PLANT OUTPUT

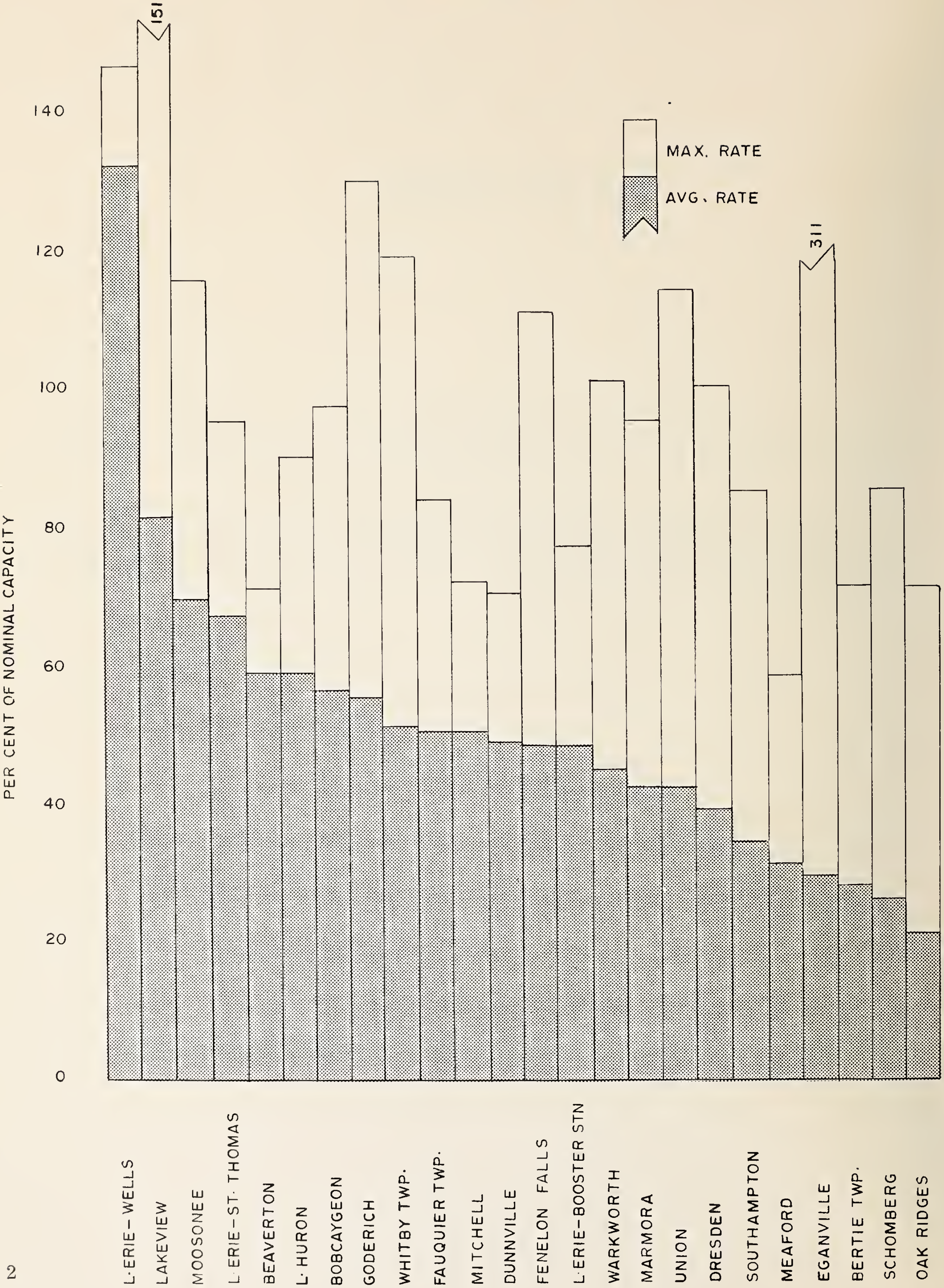

TABLE I PLANT FLOWS

PROJECT	NOMINAL CAPACITY mgd	CAPACITY OF PLANT IS LIMITED BY:	TOTAL OUTPUT mil gal	AVERAGE DAY mil gal	MAXIMUM DAY mil gal	MAXIMUM RATE mgd
Beaverton	0.55	Filter @ 1.8 gpm/ft^2	113.1	0.32	0.39	-
Bertie Twp.	4.5	Microstrainer	459.9	1.26	3.2	5.95
Bobcaygeon	0.2	Filter @ 0.5 gpm/ft^2	22.58	0.062	0.11	-
Dresden	0.5	Accelator	71.0	0.19	0.5	0.7
Dunnville	20.5	Microstrainers	3569.	9.83	14.4	14.4
Eganville	0.18	Filters @ 1.6 gpm/ft^2	13.57	0.052	0.56	-
Fauquier Twp.	0.072	Filters @ 1.6 gpm/ft^2	13.0	0.036	0.06	-
Fenelon Falls	0.36	Filters @ 2.5 gpm/ft^2	49.35	0.17	0.4	-
Goderich	1.5	Filters @ 1.8 gpm/ft^2	306.1	0.83	1.95	2.6
Harrow	1.25	Microstrainers	-	-	-	-
King Twp.						
- Oak Ridges	0.47	Softeners	33.4	0.092	0.34	-
- Schomberg	0.14	Well	13.5	0.037	0.12	-
Lake Erie						
- St. Thomas Plant	3.3	Low Lift Piping	809.2	2.21	3.14	-
- Booster Station	3.5	Pumps	590.9	1.66	2.71	-
- Wells	0.4	Pump	172.3	0.53	0.59	-
Total	7.2		1295.	3.55	-	-
Lake Huron	37.0	High Lift Pumps	7838.	21.5	33.1	39.0
Marmora	0.23	Duty Pump	35.46	0.097	0.218	-
Meaford	2.88	Filters @ 1.6 gpm/ft^2	323.0	0.88	1.67	1.73
Mitchell	0.72	Filters @ 2.5 gpm/ft^2	79.3	0.36	0.52	-
Moosonee	0.11	Filters @ 1.5 pgm/ft^2	27.72	0.076	0.127	-
Southampton	1.0	Filters @ 1.7 gpm/ft^2	122.7	0.34	0.85	-
South Peel						
- Beatty Hunter	1.8	Wells	149.8	-	-	-
- Lakeview Plant	24.	Filters @ 2 gpm/ft^2	7229.	19.81	36.3	-
- Wells	3.2	Wells	632.4	-	-	-
Union	10.	Filter @ 2.8 gpm/ft^2	1516.	4.16	8.6	10.4
Warkworth	0.10	Filter @ 2 gpm/ft^2	16.20	0.044	0.101	-
Whitby Twp.	0.16	Filter @ 2.5 gpm/ft^2	29.80	0.082	0.189	-

a. Flow records for 261 days
b. Flow records for 218 days
c. Total yearly pumpage as shown - 339 days with pumping
d. Flow records for 291 days

WATER QUALITY

Table II is a summary of bacteriological sampling carried out during the year. The indicator organisms taken were total coliforms.

Turbidity and colour of raw and treated water are summarized in Table III. The median value was taken as the average where indicated. Since there is little temperature difference between raw and treated water, only the raw water temperature is tabulated.

The results of chemical analyses of raw and treated water are summarized in Table IV. In those instances where there obviously can be no change in chemical properties (wells with chlorination only, and microstrainer plants) common values are listed.

TABLE II

	RAW WATER					PLANT EFFLUENT		DISTRIBUTION SYSTEM	
PROJECT	Number of samples with coliforms of:					Number of samples taken	Samples with coliforms <0/100ml	Number of samples taken	Samples with coliforms <0/100ml
	0	1 – 4	4–32	32-320	<320				
Beaverton	0	0	5	1	1	7	0	18	0
Bertie Twp.	6	10	18	6	0	38	0	117	1
Bobcaygeon	3	3	8	5	1	19	0	41	1
Dresden	0	0	0	1	34	2	0	43	1
Dunnville	5	8	12	11	13	51	0	96	0
Eganville	1	0	0	0	0	1	0	3	0
Fauquier Twp.	11	0	0	0	0	11	0	22	0
Fenelon Falls	4	3	7	4	0	20	0	168	1
Goderich	12	13	12	4	1	54	0	160	0
Harrow	16	8	18	8	1	51	0	102	0
King Twp.									
- Oak Ridges	2	0	0	0	0	2	0	6	0
- Schomberg	17	0	1	0	0	17	0	34	0
Lake Erie									
- St. Thomas Plant	25	11	16	1	1	65	0	59	0
- Booster Station	17	16	20			36	0	31	0
- Wells									
Lake Huron	148	1	0	0	0	300	0	0	0
Marmora	1	3	3	0	0	11	3	10	0
Meaford	10	3	9	15	15	58	0	87	0
Mitchell	59	0	0	0	0	35	0	72	0
Moosonee	7	3	5	0	0	19	2	18	0
Southampton	18	2	1	1	1	1	0	64	4
South Peel									
- Brampton Plant								43	1
- Lakeview Plant	2	7	16	6	6	45	0	217	1
- Wells	30	0	0	0	0	192			
Union	3	0	9	20	20	48	1	476	4
Warkworth	1	2	16	1	1	28	0	62	1
Whitby Twp.	7	0	0	0	0	7	0	20	0

TABLE III

PHYSICAL CHARACTERISTICS

PROJECT	TURBIDITY - JTU					COLOUR - Apparent colour units					TEMPERATURE - °F			
	RAW WATER		TREATED WATER			RAW WATER		TREATED WATER						
	AVG	MAX	AVG	MAX	% of time > 1 JTU	AVG	MAX	AVG	MAX	% of time > 5 units	AVG	MAX	MIN	% of time > 15°C
Beaverton	8	10	5	6	100	13	20	13	20	-	-	-	-	-
Bertie Twp.	3.0*	13.2	a	a	100	5	10	a	a	-	51	73	34	35
Bobcaygeon	3.0	8.0	1.2	4.0	68	15	21	6	15	-	-	-	-	-
Dresden	128	1000	1.0	4	20	88	125	5	5	-	50	77	30	39
Dunnville	4.3*	88	a	a	100	5	20	a	a	-	48	72	32	31
Eganville	2	2	4	4	100	-	-	15	15	-	-	-	-	-
Fauquier Twp.	4	8	1	1	0	18	35	10	10	-	-	-	-	-
Fenelon Falls	5	5	5	5	-	-	-	-	-	-	-	-	-	-
Goderich	5.7*	100	1.5	1.5	100	20	120	6	15	-	48	75	33	28
Harrow	3	5	4	4	100	7	10	7	10	-	-	-	-	-
King Twp.														
- Oak Ridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Schomberg	10.1	15	6	6	100	63	80	13	25	-	-	-	-	-
Lake Erie														
- St. Thomas Plt.	18	18	1.0	1.0	-	-	-	-	-	-	-	-	-	-
- Booster Station	2.2	3.8	a	a	-	-	-	-	-	-	-	-	-	-
- Wells	3.5	3.5	a	a	-	15	15	a	a	-	-	-	-	-
Lake Huron	3.2	53.0	3.5	3.5	96	5	5	10	15	-	49	75	33	31
Marmora	1.7	2	6	6	50	18	30	11	25	-	-	-	-	-
Meaford	1.0*	12.1	5.3	5.3	10	-	-	5	-	-	44	68	32	13
Mitchell	7	20	1	1	0	32	100	5	5	-	-	-	-	-
Moosonee w	5	8	3	3	137	250	5	5	-	-	39	65	30	6
Moosonee s	4	8	3	3	146	250	5	5	-	-	-	-	-	-
Southampton	4.0	5.0	1.4	1.4	5	5	5	5	5	-	-	-	-	-
South Peel														
- Brampton Plt.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Lakeview Plt.	4.4	15	8	8	66	7	20	65	5	-	-	71	36	-
Union	15.5*	67.0	7.5	7.5	90	20	55	5	5	-	53	75	34	42
Warkworth	3.0	8	2.5	2.5	50	26	60	9	25	-	-	-	-	-
Whitby Twp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-

a. As treatment does not significantly alter physical characteristics only raw values are shown

* Medium values based on plant:-
s - April to August
w - January to March / September to December

TABLE IV

CHEMICAL CHARICTERISTICS

PROJECT	HARDNESS as mg/l $CaCO^3$		ALKALINITY as mg/l $CaCO^3$		IRON as mg/l Fe		CHLORIDE as mg/l Cl^-		pH in pH units		FLUORIDE as mg/l F^-		PHENOL in ppb		AMMONIA as mg/l N	
	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED
Beaverton	149	141	121	109	.2	-	11	-	8.3	7.5						
Bertie Twp.	136		101		.17		28		-	-						
Bobcaygeon	87	87	70	65	.26	.11	5	8	8.1	7.7						
Dresden	276	180	178	69	1.23	.10	17	19	-	-						
Dunnville	138		102		0.29		27									
Eganville	82	82	44	64	.07	.15	3	16	7.9	7.7						
Fauquier Twp.	334	335	342	342	.88	.26	6	6	7.6	7.6						
Fenelon Falls	-	-	-	-	-	-	-	-	-	-						
Goderich	142	109	109	91	.65	.12	13	13	8.2	7.9	.3	.8				
Harrow	118	121	87	85	.26	.25	23	28	8.0	7.7						
King Twp.																
- Oak Ridges	199	199	313	313	1.53	1.48	2	2	7.7	7.8						
- Schomberg	228	122	337	338	1.66	.97	3	4	7.9	7.8						
Lake Erie																
- St. Thomas Plant	224	214	158	131	.83	.07	22	23	7.9	7.8	.2	1.0	18			
- Booster Station	135		99		.73		24		7.9		.2				.26	
- Wells	86		188		1.4		55		8.0		1.5				.07	
Lake Huron																
Marmora	90	91	74	70	.12	.07	4	6	7.8	7.6						
Meaford	-	92	-	75	-	.10	-	6	-	7.9						
Mitchell	258	248	204	202	.85	.05	7	6	7.7	7.7						
Moosonee w	204	201	179	184	0.8	0.13	185	189	7.7	7.4						
Moosonee s	139	135	121	118	0.8	0.11	127	115	7.7	7.5						
Southampton	98	94	87	87	.10	.15	9	7	8.7	8.8						
South Peel																
- Brampton Plant	322	-	295	-	3.22	-	18	-	7.6	-						
- Lakeview Plant	141	141	98	94	.26	.13	30	31	8.1	7.8	.2	.9	7	1	.15	.10
- Ching. Wells	280	-	251	-	.49	-	15	-	8.0	-						
Union	121	116	83	76	.89	.09	23	24	7.9	7.6	0.1	0.1				
Warkworth	217	1	204	197	.35	.10	5	6	8.2	7.9						
Whitby Twp.	260	259	230	229	.68	.22	6	7	7.6	7.6						

w - January to March / September to December
s - April to August

TREATMENT - PROCESS DATA

Table V summarizes the results of raw water algae enumeration. To minimize the effect of extreme values, geometric means were used.

The averages in Table VI are arithmetic means. The averages taken at Union and Dunnville for raw water algae include only those samples for which corresponding microstrained samples were available. The removal of algae at Union was about 56% and at Dunnville 71%, both using a microstrainer medium with openings of 35 microns.

The data available on filter operation are presented in Table VII. In some instances, information on lengths of filter runs, filter rates, etc., is not recorded.

Chemicals used in the treatment process, including chlorine used for disinfection, are summarized in Table VIII.

The quantities of alum used at Dresden, Lake Erie (St. Thomas), Moosonee and Warkworth represent the weights of the dry chemical supplied. The other plants using liquid alum have listed figures which also represent the amount of alum used as ($Al_2(SO_4)_3 . 14H_2O$).

Since some plants do not use chemicals continuously, the number of days when they were used is listed.

TABLE V

ALGAE-WATER RAW

PROJECT	1970 AVERAGE	TOTAL ALGAE - A S U per ml AVERAGE MONTHLY VALUES JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Dunnville	508	256	115	639	851	681	458	575	-	1051	-	-	751
Goderich	309	270	213	170	203	758	522	178	-	83	428	1086	-
Lake Huron	179	296	168	250	91	337	407	92	151	70	226	205	156
South Peel	148	-	-	-	361	593	246	53	38	114	156	87	210
Union	4711	4137	2264	6401	6162	7109	4004	4752	4449	6608	4856	3656	4589

Note: Averages are geometric means

TABLE VI

MICROSTRAINER PERFORMANCE

PROJECT	TOTAL ALGAE			BLUE-GREEN			GREEN			FLAGELLATES			DIATOMS		
	ASU/ml		%	ASU/ml		%	ASU/ml		%	ASU/ml		%	ASU/ml		%
	Applied	Effluent	Remov.	Applied	Effluent	Remov.	Applied	Effluent	Remov.	App	Effluent	Rem.	Applied	Effluent	Remov.
Dunnville	661	190	71	221	70	68	236	35	85	29	14	52	175	71	59
Union	56166	24810	56	2627	1242	53	5923	5501	7	5098	1804	95	42518	16263	57

TABLE VII

FILTER OPERATION

PROJECT	TYPE OF FILTER	NUMBER x AREA of FILTER n x ft^2	AVG TURBIDITY in JTU		FILTER RATE in gpm/ft^2		AVG RUN hr	BACKWASH WATER %of output
			Applied	Effluent	Average	Maximum		
Beaverton	pressure, sand	4 x 63	13.0	5.0	0.88	-	-	-
Bobcaygeon	vacuum, D. E.	1 x 180	1.5	1.2	0.24	-	-	2.3
Brampton*	-	-	-	-	-	-	-	-
Eganville	gravity, sand	2 x 38	-	-	-	-	131	-
Fauquier Twp. *	pressure, sand	2 x 13	-	-	0.96	-	144	-
Fenelon Falls	pressure, sand	2 x 50	5	5	1.18	-	48	1.2
Goderich	gravity, sand	4 x 144	3.8	1.2	1.01	3.14	32	2.6
Lake Erie	gravity, sand	4 x 400	2.2	0.4	0.96	-	38	2.9
Lake Huron	gravity, anthracite & sand	12 x 1100	-	0.3	1.13	2.05	52	4.8
Lakeview	gravity, anthracite & sand	10 x 840	-	-	1.63	-	43	1.8
Marmora	vacuum, D. E.	8 x 16	-	-	0.52	-	-	-
Meaford	gravity, anthrafilt	2 x 625	1.3	.7	.49	0.96	84	2.4
Mitchell*	pressure, anthrafilt	1 x 200	-	-	0.42	-	-	-
Moosonee	gravity, sand	2 x 28	-	-	0.95	-	-	-
Southampton	pressure, D. E.	2 x 206	4.0	0.15	0.57	-	130	-
Union	gravity, sand	4 x 650	3.8	.9	1.11	2.78	-	2.8
Warkworth	gravity, sand	1 x 35	-	-	0.89	-	-	-
Whitby Twp. *	pressure, sand	1 x 44	-	-	1.30	-	-	-

* Iron Removal Plants

TABLE VIII

CHEMICALS USED

PROJECT	CHLORINE					ALUM as $Al_2(SO_4)_3 \cdot 14H_2O$			HYDRATED LIME	SODA ASH	POLYMER	DIATOMACEOUS EARTH		ACTIVATED CARBON			SODIUM CHLORITE		SATURATED BRINE	SODIUM SILICOFLUORIDE	SODIUM BICARBONATE		POTASSIUM PERMANGANATE	CALGON
	Chlorine used 10^3lb	NaOCl solⁿ gal	DOSAGE in mg/l pre-	DOSAGE in mg/l post-	Residual (plt.eff) mg/l	No. of days used	Amount used 10^3lb	Dosage mg/l	10^3lb	10^3lb	lb	Total 10^3lb	Dose mg/l	No. of days used	Am't used 10^3lb	Dose mg/l	No. of days used	10^3lb	10^3gal	10^3lb	No of days used	10^3lb	10^3lb	lb
Beaverton	2.0			1.8	0.4																			
Bertie Twp.	6.3			1.3	0.5																			
Bobcaygeon	0.7		3.2		0.5							9.	42	160	0.5	3.7								
Dresden	1.6			2.3	1.0	143	50.0	83	141											7.6	217	1.9	1.2	
Dunnville																								
Eganville		387		2.4	0.5																			
Fauquier Twp.		271	2.5		0.3																			
Fenelon Falls	1.4			2.7	0.6																			
Goderich	3.3		1.0	.8	0.4	79	9.6	15												2.8				
Harrow																								
King Twp.																								
- Oak Ridges																								
- Schomberg																			28					
Lake Erie																								
- St. Thomas Plt.	11.4		0.9	.5		365	187	23						365	192	24.	184	46		12.6				
- L. L. & Booster Stn.	12.9		0.8																					
- Wells																								
Lake Huron	77.3		1.1	.4		340	616	8																
Markham Twp.																								
Marmora	0.9			2.7	0.5							9.	28											
Meaford	3.2		1.0		0.3																			
Mitchell																								
Moosonee		790		2.8	0.5	365	31.6	114		18.	264													270
Southampton	1.4		1.2		0.5							57.	73											
S. Peel																								
- Beatty Hunter																								
- Lakeview	99.0		0.9	0.4			396.2	5.0										34		218				
- Wells																								
Union	40.2		1.7	0.5	0.5	299	370.4	24						10	2.4	3.6				16.5	141	4.0		
Warkworth		583	2.6	1.7	0.3	365	2.0	12																
Whitby Twp.					0.5																			

PLANT STAFF

Of the seventeen projects listed, seven were operated by part-time personnel. Staff employment at the water treatment plants is summarized in Table IX.

Bertie Township, Dunnville, Goderich, Lake Erie, Lake Huron, South Peel and Union were staffed 24 hours per day. Bobcaygeon, Fenelon Falls and Moosonee were staffed 8 hours per day.

TABLE IX

PLANT STAFF

PROJECT	SUPERINTENDENT	ASSISTANT SUPERINTENDENT	CHIEF OPERATOR	ASSISTANT CHIEF OPERATOR	MECHANIC	ELECTRICIAN	CONTROL TECHNICIAN	OPERATOR	LABOURER	GROUNDSMAN/ JANITOR	CASUAL or PART-TIME	TOTAL
Bertie Twp.	-	-	1	-	1	-	-	3	-	-	0.4	5.4
Bobcaygeon	-	-	1	-	-	-	-	-	-	-	0.4	1.4
Dunnville	1	-	-	-	1	-	-	6[a]	-	-	0.0	8.0
Fauquier Twp.	-	-	-	-	-	-	-	-	-	-	0.4	0.4
Fenelon Falls	-	-	1	-	-	-	-	-	-	-	0.3	1.3
Goderich	-	-	1	1	-	-	-	3	-	-	0.6	5.6
King Twp. - Oak Ridges	-	-	-	-	-	-	-	-	-	-	0	0
- Schomberg	-	-	-	-	-	-	-	-	-	-	0.3	0.3
Lake Erie	1	-	-	-	1	-	-	6	3[e]	-	1.0	12.0
Lake Huron	1	[b]	-	-	1	1	1	11	2	-	3.0	20.0
Meaford	-	-	-	-	-	-	-	-	-	-	1.0	1.0
Moosonee [c]	-	-	0.5	-	-	-	-	0.5	-	-	-	1.0
Southampton	-	-	-	-	-	-	-	-	-	-	1.0	1.0
South Peel	1	-	1	-	4	-	1	18	2	2	0.5	29.5
Union	1	[d]	-	-	1	1	-	5	-	2	-	10.0
Warkworth	-	-	-	-	-	-	-	-	-	-	0.5	0.5
Whitby Twp.	-	-	-	-	-	-	-	-	-	-	0.3	0.3

a. Operator is Assistant Superintendent
b. Mechanic is Assistant Superintendent
c. Operated with Moosonee WPCP
d. Electrician is Assistant Superintendent
e. Includes two Temporary Employees

OPERATING COSTS

The cost of operation of the water treatment plants used in this report include payroll of staff employed at the plants, fuel, power, chemicals, general supplies, equipment, repairs and maintenance, sundry, water, and travel. The cost of head office supervision, including travel, accounting, purchase and inspection, is not charged against the project.

An explanation of items included in each of the categories of the operating costs follows:

1. Payroll - Regular: Staff salaries, including pension, medical plant, and Workmen's Compensation payments.
   - Casual: Salaries of labour employed on a temporary or part-time basis during staff shortages, or for part-time work. Workmen's Compensation payments are also included.
2. Fuel - Include fuel oil, natural gas or propane used for heating.
3. Power - Includes hydro-electric power plus natural gas, gasoline, diesel fuel, if used for power generators.
4. Chemicals - Includes chlorine, sodium hypochlorite, diatomaceous earth, hydrated lime, alum, activated carbon and salt.
5. General Supplies - Includes laboratory reagents, laboratory equipment replacement, cleaning materials, lubricants, stationery, uniforms, light bulbs, instrument charts, books, etc.
6. Equipment - Includes equipment to be used in the treatment process, laboratory, building, grounds, maintenance, and small tools.
7. Repairs & Maintenance - Includes goods and services (excluding OWRC staff) used in the repair and maintenance of process, electrical equipment and buildings, inspections, packing materials, paints, etc.
8. Sundry - Includes express charges, telephone, telemetering, insurance, taxes, etc.
9. Water - Includes all charges for water.
10. Travel - Includes operators' travel to local hardware stores, railroad stations, conferences, conventions, etc. The cost of accomodation and meals associated with conferences and conventions is also included.

Table X summarizes the total annual costs for the categories described above for each project.

Graph No. 2 displays unit operating costs as a function of plant size for the 14 projects operated during the entire year, where all costs were charged to the projects.

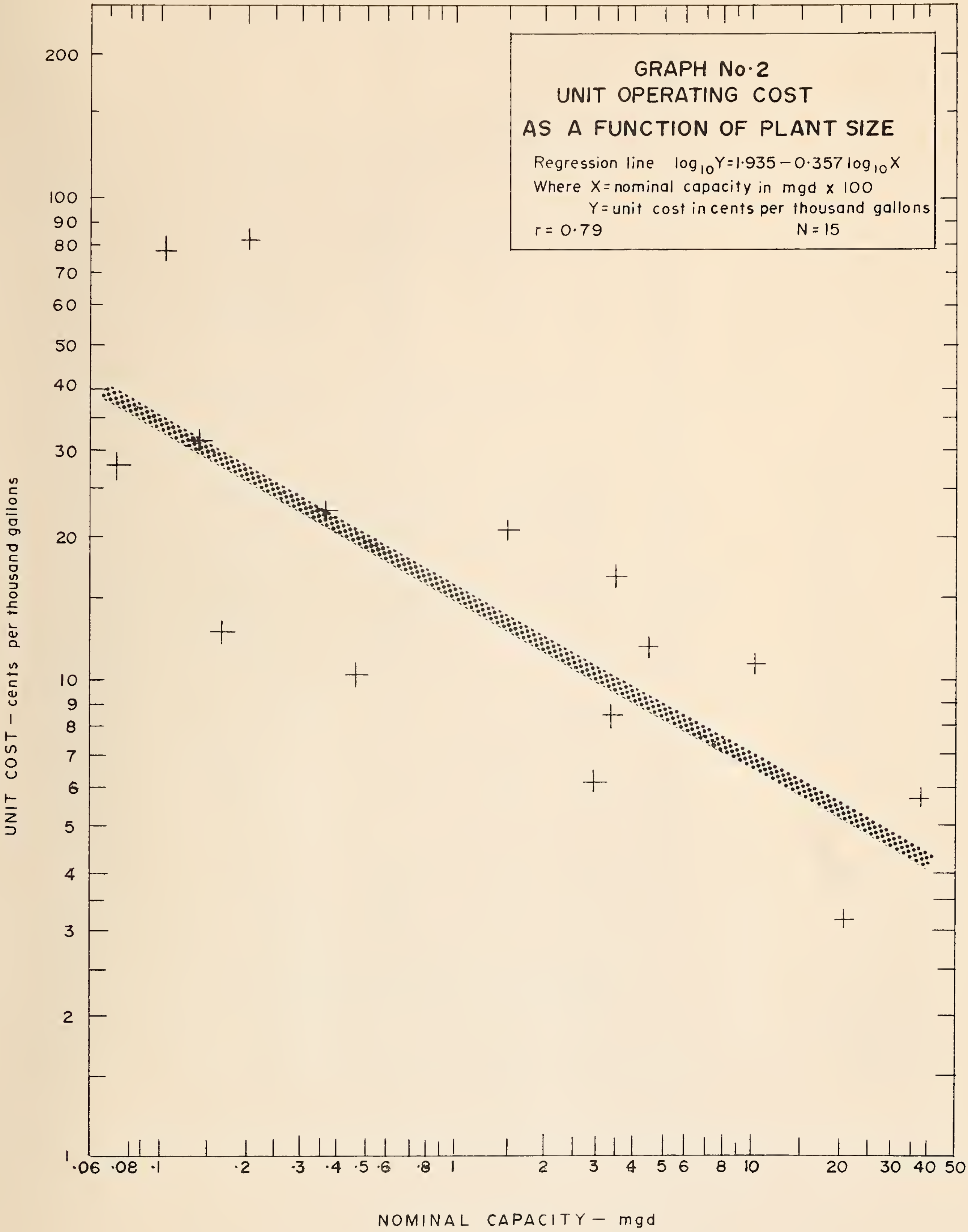
GRAPH No·2
UNIT OPERATING COST
AS A FUNCTION OF PLANT SIZE
Regression line $\log_{10}Y=1{\cdot}935-0{\cdot}357\log_{10}X$
Where X = nominal capacity in mgd x 100
Y = unit cost in cents per thousand gallons
r = 0·79
N = 15
UNIT COST – cents per thousand gallons
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
·06
·08
·1
·2
·3
·4
·5
·6
·8
1
2
3
4
5
6
8
10
20
30
40
50
NOMINAL CAPACITY – mgd

TABLE X

Note: Units are dollars except where noted

OPERATING COST ~ 1970

PROJECT	UNIT COST c/1000gal	TOTAL	SALARIES REGULAR	SALARIES CASUAL	FUEL	POWER	CHEMICALS	GENERAL SUPPLIES	EQUIPMENT	REPAIRS and MAINTENANCE	SUNDRY	WATER	TRAVEL
Beaverton	-	149.01									149.01		
Bertie Twp.	12.2	56256.95	35325.75	2723.43	905.41	11352.44	904.78	1017.38	152.25	2273.39	976.09		626.03
Bobcaygeon	86.1	19460.53	8148.61	1227.74	10.66	1589.64	1109.96	662.02	2314.13	1138.83	2985.24		273.70
Dresden	3.1	2199.32					1823.20				376.12		
Dunnville	3.3	118466.45	59971.70		990.31	38848.65	3197.00	2912.48	1502.55	4128.65	6390.06	(82.33)	607.38
Eganville	10.1	1357.34					789.00	65.32		399.37	103.65		
Fauquier Twp.	29.2	3791.59	16.83	1579.97		1589.67	292.50	90.97		136.09	85.56		
Fenelon Falls	23.3	14463.29	8565.51	1457.03			218.63	742.25	125.02	1651.13	791.10		912.62
Goderich	20.8	64041.65	38340.49	3845.33		7782.70	1311.24	939.78	418.40	1460.59	9406.93		536.19
Harrow	-	(246.20)						174.13		(898.50)	578.17		
King Twp.													
- Oak Ridges	10.3	3440.83	8.47	676.16		1861.06	113.40	54.76		538.57	188.41		
- Schomberg	32.8	4429.42	14.35	1763.85		1113.94	1115.12	179.96		30.09	92.86		119.25
St. Thomas	8.8	71389.25	24310.68		177.57	23787.50	3298.68	2640.61	184.97	3204.59	3149.91		634.74
Lake Erie	16.3	96488.13	55570.84	1642.78	754.81	15899.79	6298.50	2231.16	2209.96	2545.09	8830.85		504.35
Lake Huron	5.7	445213.32	123005.05	13004.55		168148.75	24724.04	6184.58	54689.94	19830.10	32586.87		3039.45
Marmora	6.0	2138.05					1281.50			658.34	198.21		
Meaford	6.0	19490.60									19490.60		
Mitchell	-	102.82									102.82		
Moosonee	80.3	22262.62	6658.26		1427.65	5794.50	5725.07	77.57	1137.56	774.68	481.95		185.38
Southampton	14.6	17907.16					4034.11	145.05	122.53	3539.62	10065.85		
South Peel	6.5	519558.96	247385.05	3716.20	936.89	94558.01	70583.32	20776.35	10173.37	11478.58	58651.57		1299.62
Union	10.5	159234.94	82605.84	32.00	2881.06	26829.75	18089.31	4414.49	430.35	3566.41	18797.90		1587.83
Warkworth	23.5	3814.37	12.50	2090.29		702.13	420.05	138.14	26.32	312.52	112.42		
Whitby Twp.	12.4	3713.07	14.89	1639.55		1225.44	396.00	56.67	58.80	171.51	150.21		

Brackets indicate credit

Water management in Ontario